

Tex-242-F, Hamburg Wheel-tracking Test

Overview

Effective: June 2000 - August 2000.

Use this test method to determine the susceptibility of bituminous mixtures to moisture damage. Measured properties are rut depth measurements, number of passes at the stripping inflection point, and number of passes to failure.

Apparatus

The following apparatus is required:

- ◆ Wheel-tracking Device
 - An electrically powered device capable of moving a steel wheel with a diameter of 203.6 mm (8 in.) and width of 47 mm (1.85 in.) over a test specimen.
 - The load applied by the wheel is 705 ± 22 N (158 ± 5 lbs.).
 - The wheel must reciprocate over the test specimen, with the position varying sinusoidally over time.
 - The wheel shall make approximately 50 passes across the test specimen per minute.
 - The maximum speed of the wheel must be approximately 0.305 m/s (1.1 ft/sec) and will be reached at the midpoint of the slab.
- ◆ Temperature Control System
 - A water bath capable of controlling the test temperature within ± 2 °C (4 °F) over a range of 25 to 70 °C (77 to 158 °F).
 - This water bath must have a mechanical circulating system to stabilize temperature within the specimen tank.
- ◆ Rut Depth Measurement System
 - A Linear Variable Differential Transducer (LVDT) device capable of measuring the rut depth induced by the steel wheel within 0.01 mm, over a minimum range of 20 mm.
 - The system shall be mounted to measure the rut depth at the midpoint of the wheel's path on the slab.
 - Rut depth measurements must be taken at least every 100 passes of the wheel.
 - This system must be capable of measuring the rut depth without stopping the wheel. This measurement must be referenced to the number of wheel passes.
- ◆ Wheel Pass Counter
 - A non-contacting solenoid that counts each wheel pass over the test specimen.
 - The signal from this counter must be coupled to the rut depth measurement, allowing for the rut depth to be expressed as a fraction of the wheel passes.

◆ Specimen Mounting System

- A stainless steel tray which can be mounted rigidly to the machine in the water bath.
- This mounting must restrict shifting of the specimen during testing.
- The system must suspend the specimen, allowing for free circulation of the water bath on all sides.
- The mounting system shall be designed to provide a minimum of 2 cm (0.79 in.) of free circulating water on all sides of the sample.

Materials

The following materials are required:

- ◆ Two acrylic molds shaped according to plan view in figure 1 to secure circular, cylindrical test specimens.
- ◆ Capping compound able to withstand 890 N (200 lb.) load without cracking

Specimen

◆ Laboratory Molded Specimen

- Prepared according to test methods "Tex-205-F, Laboratory Method of Mixing Bituminous Mixtures" and "Tex-241-F, Superpave Gyratory Compacting of Test Specimens of Bituminous Mixtures."
- Specimen diameter shall be 152 mm (6 in.) and specimen height should be 62 ± 2 mm (2.4 ± 0.1 in.).
- Density of test specimens must be $93 \pm 1\%$.

◆ Core specimen

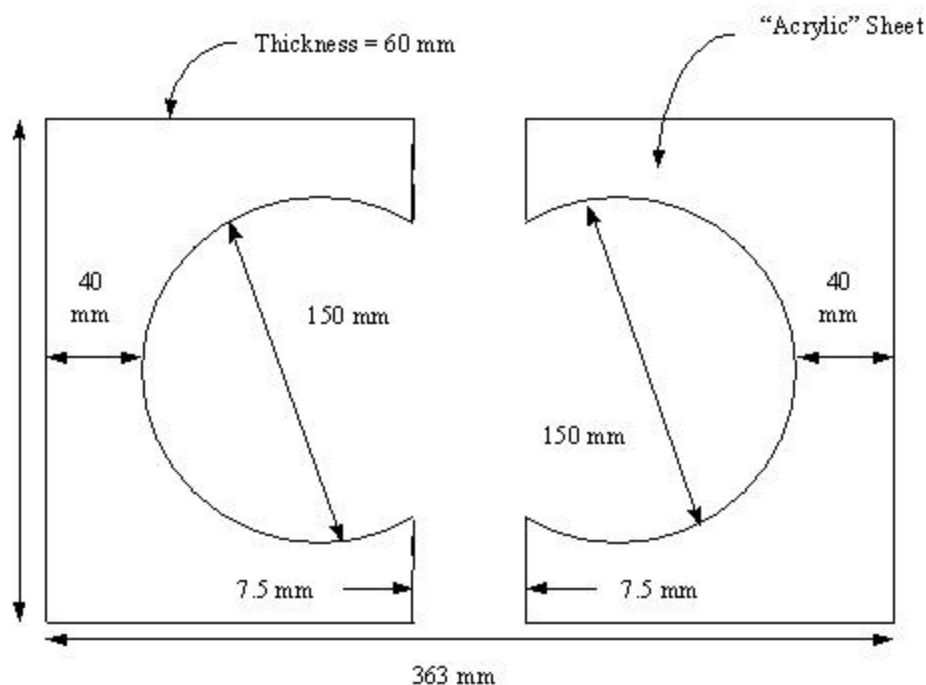
- diameter of 152 ± 2 mm (6 ± 0.1 in.) or 254 ± 2 mm (10 ± 0.1 in.).

Procedure

The following steps outline the procedures for preparing and testing the sample.

Sample Preparation and Testing	
Step	Action
1	Measure the relative density of specimens according to test methods "Tex-207-F, Determining Density of Compacted Bituminous Mixtures" and "Tex-227-F, Theoretical Maximum Specific Gravity of Bituminous Mixtures."
2	<ul style="list-style-type: none"> • Trim one end of each specimen with a masonry saw. Use a mold with dimensions as shown in 'Top View of Test Specimen Configuration for the Hamburg Wheel-tracking Device' as a guide. • Place a specimen in the mold and saw it along the edge of the mold. The cut is approximately 16 mm (5/8 in.) deep to fit acrylic mold.
3	<ul style="list-style-type: none"> • Place acrylic molds into the mounting tray and fit specimens into each one. • Secure the acrylic molds into the mounting tray. <i>Do not use acrylic molds for core</i>

Sample Preparation and Testing	
Step	Action
	<i>specimens greater than 152 mm (6 in.) in diameter.</i> <ul style="list-style-type: none"> • Mix capping compound. • Spray the mounting tray with a light lubricant. • Place specimen in the middle of the mounting tray. • Spread the capping compound around the core specimen until level with the surface. • Allow the capping compound to dry up to 24 hours.
4	<ul style="list-style-type: none"> • Fasten the mounting trays into the empty water bath. • Close both valves located under the testing device and fill with water.
5	Start the software supplied with the machine and enter test information into the computer.
6	<ul style="list-style-type: none"> • Test temperature for the testing of laboratory prepared specimens with an unmodified PG64-22 or AC-20 is 40 ± 1 °C (104 ± 2 °F). • Specimens with an asphalt binder higher in viscosity or stiffer than an unmodified PG64-22 or AC-20 is 50 ± 1 °C (122 ± 2 °F). • Test temperature for the testing of field cores is 50 ± 1 °C (122 ± 2 °F). • Fill the water bath until the water temperature is at the desired test temperature. The temperature of the water can be monitored on the computer screen. • Allow the test specimens to be saturated in the water for an additional 30 minutes once the desired water temperature has been reached.
7	Start the test after the test specimens have been in the water for 30 minutes at the desired test temperature. The testing device automatically stops the test when the device applies the number of desired passes or when the maximum allowable rut depth has been reached.



** Not drawn to scale

Figure 2-5. Top View of Test Specimen Configuration for the Hamburg Wheel-tracking Device.

Calculations

Plot the rut depth versus number of passes for each test. A typical plot of the output produced by the Hamburg Wheel-tracking Device is shown in 'Hamburg Curve with Test Parameters.' From this plot, obtain the following values:

- ◆ Slope and intercept of the first steady-state portion of the curve
- ◆ Slope and intercept of the second steady-state portion of the curve.

Calculate the following test parameters:

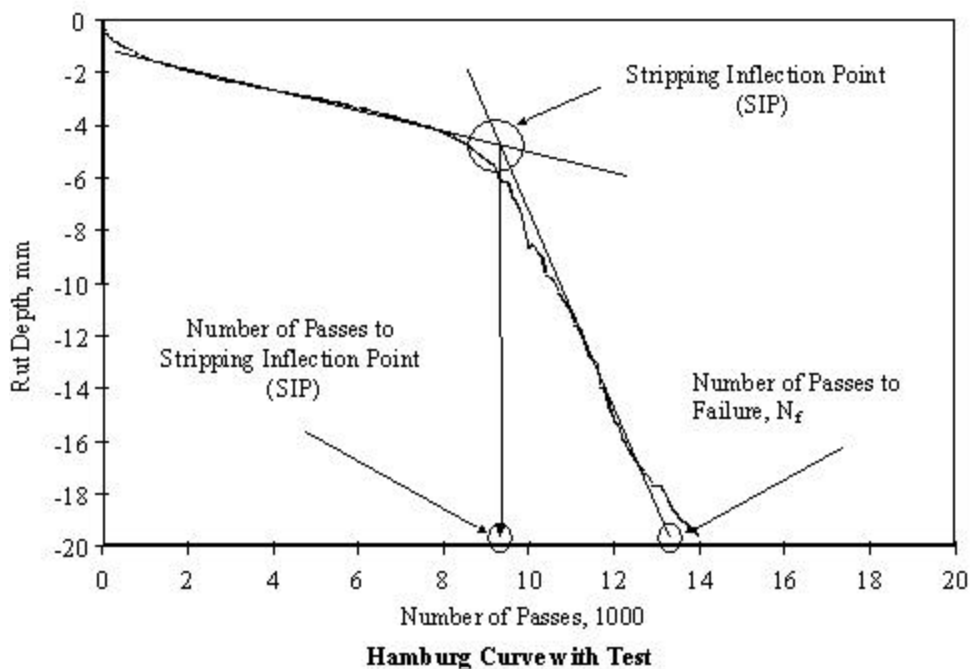
- ◆ All of the test parameters below are expressed in 'Passes'

$$\text{Stripping Inflection Point} = \frac{\text{Intercept (sec ond portion)} - \text{int ercept (first portion)}}{\text{Slope (first)} - \text{Slope (sec ond)}}$$

$$\text{Number of Passes to Failure} = \frac{\text{Failure Rut Depth} - \text{Intercept (sec ond portion)}}{\text{Slope (sec ond portion)}}$$

Where:

- ◆ Failure Rut Depth is the specified maximum allowable rut depth for the test.



It is important to note that not every curve may have two steady-state portions, due to pre-mature failure.

Figure 2-6. Hamburg Curve with Test Parameters.

Report

For each specimen, report the air void content, anti-stripping additive used, number of passes at the stripping inflection point, and number of passes to failure or rut depth at the end of the test.